

Study on some Chemical Analyses and Antimicrobial Screening of *Musa Sapientum* L. (Banana) from Hinthada Township

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Abstract

In this study, the selected fruit of *Musa sapientum* L. (Yay-thi Banana) belongs to pharmacological values, and is also used in commercial food products for its fragrance and sweet taste. The aim is to study the some chemical analyses especially in nutrients for food supply of the fruit of *Musa sapientum* and antimicrobial screening of its extracts. The ripe fruit sample was collected from Yonthalin Village in Hinthada Township. At first, phytochemical tests have revealed that the absence of cyanogenic glycosides in the sample by test tube method. The sample had relatively the highest content of K according to EDXRF spectrum. The nutritional values were performed by A.O.A.C method and vitamin C content was done by iodometric titration. Using standard amino acid, the varieties of free amino acid constituents from the fruit sample were estimated and confirmed by TLC method visualized in ninhydrin reagent. It was found to contain four free amino acids: arginine, tryptophan, threonine and methionine need for daily diet. By using direct extraction method, four crude extracts of the sample were prepared with various solvents: petroleum ether, ethyl acetate, 96 % ethanol and water. The antimicrobial activity of these extracts was studied on ten microorganisms by paper disc diffusion method. The four crude extracts of *Musa sapientum* showed remarkable inhibition zone diameter (18-22) mm against *Candida albicans* NITE09542 related to candidiasis diseases. From the results of present study, it was observed that *Musa sapientum* could be applied as the local health remedy to the local indigenous communities of our country and also it could be expected to become a potential food source. So it would be suggested that Yay-thi Banana should be grown in Hinthada Township for both food source and earning. This paper may support and contribute the knowledge to local people for their health and economy.

Keywords: *Musa sapientum*, nutrients, amino acids, TLC, antimicrobial activity

Introduction

The study of traditional medicinal plants and their therapeutics plays a very important role in health care system of Myanmar because 70% of its population is in the rural area and they have been using traditional medicine for centuries (Hun Tun, 1993). Therefore, safe, scientific and systematic development of effective drugs is mandatory to ensure the well-being of Myanmar people. "Let food be your medicine and medicine be your food", said Hippocrates in the fifth century, and in the very earliest days of civilization, nutrition has formed the backbone of health care (Dahanukar *et.al.*, 2000). In this study, *Musa sapientum* L. (Banana) was selected to find out some nutrients and active principle for the treatment of candidiasis, GI tract infection and abscess. There are over 300 varieties of bananas worldwide and they are eaten around the world. Banana has a great nutritional significance. Although fat and protein contents are very low, they are rich in some minerals: phosphorous, potassium, magnesium, iron and calcium. Bananas are a good fuel for the brain because the potassium helps to concentrate and think clear (Pinn, 2001). Banana is composed of healthy benefiting amino acids besides some secondary metabolites which possess precious pharmacological values (Schobert, *et al.*, 2010). In addition, amino acids are the main components of proteins. Approximately twenty amino acids are the common constituents of proteins. The biochemical classification separates them into essential and non-essential amino acids. Essential amino acids are those that cannot be synthesized by an organism and must therefore be available to the organism in its food supply. The ten amino acids essential to human are arginine,

histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan and valine. Non-essential amino acids are those that can be synthesized by organisms, either from essential amino acids or from other metabolic sources (Marmor, 1987). Detection of amino acids can be achieved readily by the test of ninhydrin (2,2-Dihydroxyindane-1,3-dione).

In fact, Banana is not only delicious but also good source of nutrients for human health. Furthermore, it is mostly cultivated in Yonthalin Village, Hinthada Township, Ayeyarwady Region. Therefore, the present research which is designated to examine some chemical analyses such as phytochemicals, nutrient elements, nutritional values, vitamin C content, some essential amino acids, and screening of antimicrobial activity.

Selected Myanmar Traditional Medicinal Plant

Botanical aspects of *Musa sapientum*

Family	- Musaceae
Genus	- <i>Musa</i>
Species	- <i>sapientum</i>
Botanical Name	- <i>Musa sapientum</i> L.
Myanmar Name	- Yakhine-nget-pyaw
Local Name	- Yay-thi
English name	- Banana
Parts used	- Ripe fruit
Fruit	- Oblong and yellow when ripe, 6-8 cm by 4-6 cm, glabrous, thin skin; pulp pale yellow or cream coloured, sweet; hands 5-7 in each bunch, with 12-15 fingers in each hand (Kress, <i>et al.</i> , 2003)



Figure (1) (a) Plant of *Musa sapientum* L. (Yay-thi Banana)



(b) Ripe fruit of *Musa sapientum* L. (Yay-thi Banana)

Distribution

The plant of Banana shown in Figure 1 (a) is widely distributed throughout Myanmar, especially in Yonthalin Village, (Hinthada Township, Ayeyarwady Region) and Kyaut-Se, Mandayar, Shan-Ka-Lay-Kyun, Ywar-Ngan and Sagaing Region (Kress, *et al.*, 2003).

Chemical Constituents

The chemical constituents of the fruit of *Musa sapientum* L. (Banana) shown in Figure 1 (b) are reputed to contain vanillic acid, ferulic acid, beta- sitosterol and daucosterol (Ashin Nagathein, 1971).

Materials and Methods

Plant Materials

The fruit of *M. sapientum* (Banana), local name (Yay-thi) was collected from Yonthalin Village, Hinthada Township, Ayeyarwady Region in July, 2018. After being collected, the scientific name of the sample was identified by authorized botanists at Department of Botany, Hinthada University. The fruit sample was washed, cleaned and dried at room temperature for three weeks. Then the dried sample was powdered and stored in air-tight container.

Instruments: Shimazu EDX-7000/8000 (Monywa University), soxhlet, TLC tank, water bath, conical flask, micropipettes, petri-dishes, test-tubes, measuring cylinders, a hot plate stirrer; a refrigerator, wire loops, straight wire, spirit burner and aluminium foil, digital calipers

Chemicals: Petroleum ether (PE), ethyl acetate (EtOAc), ethanol (96% EtOH), TLC: precoated silica gel 60 (F₂₅₄ Aluminium plates, Merck), mobile phase: n- butanol-acetic acid-water (BAW), authentic amino acids: arginine, tryptophan, threonine, methionine (BDH, Biochemical), ninhydrin reagent, antimicrobial activity: test broth medium and assay medium

Preliminary Phytochemical Tests of Fruit of *M. sapientum* by Using Test Tube Method

Preliminary phytochemical investigation was carried out on powdered, dried sample of fruit of *M. sapientum* with a view to determine the presence or absence of alkaloids, α -amino acids, carbohydrates, cyanogenic glycosides, flavonoids, glycosides, organic acids, phenolic compounds, reducing sugar, saponin glycosides, starch, steroids, tannins and terpenoids.

Determination of Elemental Analysis of Fruit of *M. sapientum* by EDXRF Spectrometry

Semi-Quantitative elemental analysis of fruit of *M. sapientum* was carried out by EDXRF method. Dried powder sample was fabricated into pellet by using pellet making machine. The pellet of sample was analysed by using EDXRF spectrometer at Monywa University.

Examination of Nutritional Values of the Fruit of *M. sapientum*

Some nutritional values such as moisture, ash, crude protein, crude fibre, crude fat, carbohydrate and energy value of the fruit of *M. sapientum* were determined by using A.O.A.C method at Myanmar Food Processors and Exporters Association (MFPEA), Yangon. Vitamin C (ascorbic acid) content in fruit sample was performed by iodometric titration.

Qualitative Tests of Amino Acids of the Fruit of *M. sapientum*

Extraction of total amino acids and screening on qualitative reactions of amino acids

The air dried sample (30 g) was taken place in a conical flask and 96 % ethanol (150 mL) was added. Then the mixture was heated in a water bath for about 30 mins and cooled down. And then the solution was filtered and centrifuged to be used as test sample solution. The supernatant was decanted in a test tube and analysed for the various qualitative tests of amino acids with the use of reagents: ninhydrin, xanthoproteic, glyoxylic and sakaguchi by test tube method to develop the colour change.

Qualitative Estimation of Free Amino Acids from the Fruit of *M. sapientum*

Separation and identification of amino acids in test sample solution (96% ethanol extract) with the comparison of standard amino acids by thin layer chromatography

Separation and identification of amino acids in test sample solution was done by thin layer chromatography (TLC) with the comparison of standard amino acids solution. In this method, solvent system: n-butanol - acetic acid - water (BAW) (4:1:5) (v/v) and ninhydrin reagent were used to develop a chromatogram. The tank to be used for TLC was firstly cleaned and dried. The solvent was poured into the tank in order to allow the TLC plate to dip into a depth of 0.2 cm. 3 x 3 cm plate was applied with sample solution for one-dimension. A base line was drawn with a pencil along 0.3 cm from one edge in length on the plate. On the front side, a line paralleled to the base line, was drawn along 0.2 cm from the edge so that the solvent front would be reached to 2.5 cm from the base line. To be spotted on the plate, was marked on the base line with a pencil. After spotting, the plate was carefully placed into the tank by holding it with forceps so that the lower edge having origins was inserted into the solvent to the depth of approximately 0.2 cm approximately in all cases. The tank was then covered with the lids as quickly as possible. After developing TLC, the plate was removed from the tank and dried. Amino acids were detected by spraying the plate with 0.2 % ninhydrin reagent. Four violet spots could be observed from thin layer chromatogram of test sample solution (96 % ethanol solution). The R_f values of four violet spots observed from TLC were identified with the R_f values of standard amino acids.

Preparation of Extracts from Fruit of *M. sapientum*

The powdered sample of fruit of *M. sapientum* (50 g) was extracted from (500 mL) petroleum ether (PE) (60-80 °C), ethyl acetate (EtOAc) and 96 % ethanol (96 % EtOH) in separate conical flasks, respectively for at least three weeks and then filtered. Water extract of fruit sample was prepared by boiling 50 g of sample with 500 mL of distilled water for 6 h and filtered. It was repeated three times and the filtrates were combined followed by removal of the water to give water extract. The filtrates were evaporated by using sand bath and desiccated. Then the dried extracts were weighed. Extractive values were described in terms of % in weight by weight on the powdered materials. Solvent was removed as before until a constant weight of extracts was obtained. The four crude extracts from the fruit of *M. sapientum* were applied to investigation of antimicrobial activity.

***In vitro* Studies on the Antimicrobial Activity of Four Crude Extracts of Fruit of *M. sapientum* Against Ten Tested Microorganism by Paper Disc Diffusion Method**

For the examination of *in vitro* antimicrobial activity of polar and non-polar extracts of Fruit of *M. sapientum* (Banana), paper disc diffusion method was used because of its simplicity, speed of performance, economy and reproducibility (Finogold *et al.*, 1978). The antimicrobial activity of four crude extracts such as petroleum ether, ethyl acetate, 96 % ethanol and water extracts were determined against ten microorganisms such as

Agrobacterium tumefaciens NITE09678, *Aspergillus parasciticus* IFO5123, *Bacillus subtilis* IFO90571, *Candida albicans* NITE09542, *Micrococcus luteus* NITE83297, *Salmonella typhi* AHU9743, *Escherichia coli* AHU5436, *Saccharomyces cerevisiae* NITE52847, *Pseudomonas fluorescens* IFO94307 and *Staphylococcus aureus* AHU8465 by employing paper disc diffusion method at Department of Chemistry, Hinthada University. 10 µL of crude extracts was put on paper disc and air-dried at room temperature for 12 h. The test organisms were incubated in test broth medium containing glucose (0.5 g), polypeptone (0.2 g) and distilled water (100 mL) at appropriate temperature for 24 h. Assay medium containing glucose (1.0 g), polypeptone (0.2 g), agar (1.6 g) and distilled water (100 mL) were placed in a beaker and the contents were heated for 10 min. The assay medium was put into sterilized conical flask and plugged with cotton wool and then autoclaved at 121°C for 15 mins. After cooled down to 40 °C, 0.1 mL of suspended strain was inoculated to the assay medium with the help of a sterilized disposable pipette near the burner. About 20 mL of medium was poured into the sterilized petri-dishes and allowed to set the medium. Once solidified the dishes were cooled for 2 h at room temperature. After solidification, paper discs impregnated with samples (crude extracts) were applied on the agar plates which were incubated at 27°C for 24-36 h. After overnight incubation at 27°C, the zones of inhibition diameter including 8 mm discs were measured by digital calipers in millimeter. If clear zones (inhibitory zones) surrounding the paper discs were found to be indicated that it would be the presence of bioactive metabolites which inhibit the growth of test organisms. A blank petri-dish without microorganisms was used as negative control and incubated petri-dish was taken as positive control besides antibiotics, chloramphenicol was also used as standard for this study.

Results and Discussion

Preliminary Phytochemical Examination of Fruit of *Musa sapientum*

In this research work, fruit of *M. sapientum* was collected from Yonthalin Village, Hinthada Township, Ayeyarwady Region and then made the powdered samples, and stored in air-tight bottles for phytochemical investigations. Phytochemical screening serves as an initial step in expanding the knowledge about plant constituents and interest of phytochemists trying to recover new sources of biologically active phytochemical. For this reason, the phytochemical test was carried out on fruit of *M. sapientum* and it was found that the fruit sample consists of alkaloids, α -amino acids, carbohydrates, flavonoids, glycosides, organic acids, phenolic compounds, reducing sugar, saponin glycosides, starch, steroids, tannins and terpenoid compounds. However, cyanogenic glycosides were not found in it. The results obtained were summarized in Table 1.

Determination of Elemental Analysis on the Fruit of *Musa sapientum* by EDXRF Spectrometry

X-ray spectrometer permits simultaneous analysis of light to heavy elements. Shimadzu EDX-7000/8000 spectrometer can analyse the element from sodium to uranium. Under vacuum condition, EDXRF spectra of the fruit of *M. sapientum* (Banana) sample was shown in Figure 2 and related Table 2. In the fruit sample of *M. sapientum*, four kinds of elements such as K, S, Fe and Cu were detected. Among these elements potassium peak was also the most prominent and so it showed that potassium was the highest content of this plant. Potassium is an important component of cells and body fluids that help heart rate and blood pressure. Thus, the fruit sample of *M. sapientum* benefits to human health because it contains some essential nutrient elements which play in a vital role of biological system.

Determination of Nutritional Values of the Fruit of *Musa sapientum*

The powder of the fruit of *M. sapientum* (Banana) was investigated in the content of moisture, ash, protein, fibre, fat, carbohydrate and energy value by A.O.A.C standard methods and the obtained results were shown in Table 3 and related histogram was exhibited in Figure 3. Because the result of ash content of sample is low, it could be remarked that less amount of inorganic materials contained in this sample than that of organic materials. In addition, low-fibre content of *M. sapientum* indicated that it could help to digestion with complete or partial fermentation in the large intestine and could be eaten raw or cooked. Moreover, fat content was very low, so it may be used as antiobesity whereas a diet high in carbohydrates can upset the delicate balance of human body's blood sugar level, resulting in fluctuations in energy and mood which leave our feeling irritated and tired. Next, vitamin C (Ascorbic acid) content in vitamin C tablet (MPF), standard and the fruit of *M. sapientum* (Banana) sample have been determined by iodometric titration. Ascorbic acid content in the fruit of *M. sapientum* (Banana) was found to be 18.2 mg per 100 g fresh weight. It was obvious that the ascorbic acid content in fruit of *M. sapientum* (Banana) was comparable with literature value, 20 mg/ 100 g shown in table (4).

Table (1) Results of Preliminary Phytochemical Examination of the Fruit of *M. sapientum*.

No.	Test	Extracts	Reagents used	Observation	Remark
1	Alkaloids	1% HCl	Mayer's reagent Dragendorff's reagent Wagner's reagent Sodium Picrate Solution	Creamy ppt Orange ppt Reddish brown ppt Yellow ppt	+ + + +
2	α -amino acids	H ₂ O	Ninhydrin reagent	Purple colour	+
3	Carbohydrate	H ₂ O	10 % α -naphthol & conc: H ₂ SO ₄	Red ring	+
4	Cyanogenic glycosides	H ₂ O	Sodium picrate solution	No brick red	-
5	Flavonoids	96 % EtOH	Dil. NaOH & Dil. HCL	Yellow colour	+
6	Glycosides	H ₂ O	10 % lead acetate	White ppt	+
7	Organic acids	H ₂ O	Bromocresol green	Blue colour	+
8	Phenolic compounds	96 % EtOH	5 % FeCl ₃ solution	Deep blue colour	+
9	Reducing sugars	H ₂ O	Benedict's solution	Green colour	+
10	Saponins	H ₂ O	Distilled water	Marked Frothing	+
11	Starch	H ₂ O	Iodine solution	Blue colour	+
12	Steroids	PE	Acetic anhydride & conc: H ₂ SO ₄	Green colour	+
13	Tannins	96 % EtOH	1 % Gelatin	white ppt	+
14	Terpenoids	96 % EtOH	Acetic anhydride & Conc. H ₂ SO ₄	Red colour	+

(+) = presence

(-) = absence

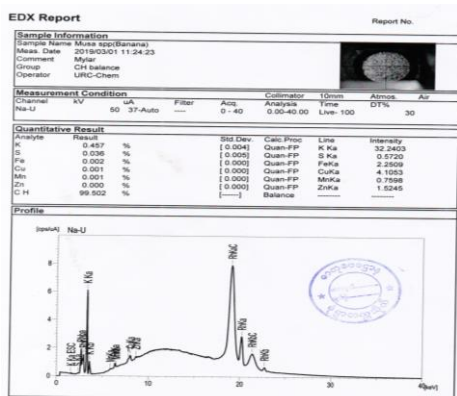


Figure (2) EDXRF spectrum of the fruit of *M. sapientum*

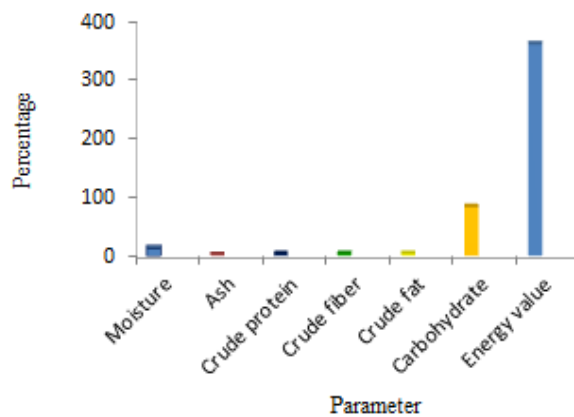


Figure (3) Some nutritional values of the fruit of *M. sapientum*

Table (2) Qualitative Elemental Analysis of Fruit of *M. sapientum* by EDXRF

No.	Element	Relative Abundance (%)
1	K	0.457
2	S	0.036
3	Fe	0.002
4	Cu	0.001
5	C/H	99.826

Table (3) Some Nutritional Values from the Fruit of *M. sapientum*

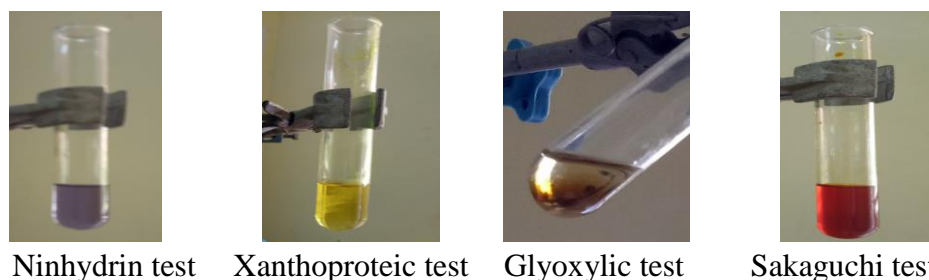
No.	Parameters	% Contents (w/w)
1	Moisture	10.79
2	Ash	1.03
3	Crude Protein	2.46
4	Crude Fibre	1.94
5	Crude Fat	2.29
6	Carbohydrate	81.49
7	Energy Value (Kcal/ 100g)	356.41

Table (4) Ascorbic Acid Content in Vitamin C Tablet and the Fruit of *M. sapientum*.

Name of Samples	Observed value/(mg)*	**Literature value/(mg)
Cevit from (MPF)	100	100
Fruit of <i>M. sapientum</i> (Banana)	18.2	20

* mg/100 g fresh weight sample & mg/one tablet cevit

** (Ceirwyn and James, 1999)



Ninhydrin test Xanthoproteic test Glyoxylic test Sakaguchi test

Figure (4) Qualitative tests of amino acids in the fruit of *M. sapientum* (Yay-thi Banana).

Determination of Amino Acid Contents in *Musa sapientum*

The amino acid contents in the fruit of *M. sapientum* (Yay-thi Banana) was qualitatively investigated. Firstly, qualitative tests of amino acid were done by test tube method. From these results, it was found that the fruit of Yay-thi banana contained four free amino acids such as arginine, tryptophan, threonine and methionine shown in figure (4) and table (5).

Furthermore, separation and identification of amino acid constituents from the fruit of Yay-thi Banana were determined by one dimension thin layer chromatography technique shown in figure (5) and (6). The amino acid constituents in Yay-thi Banana were identified and confirmed with the R_f values of standard amino acids and these results were shown in table (6).

Table (5) Qualitative Estimation of Free Amino Acids in the Fruit of Yay-thi Banana

No.	Experiment	Reagent used	Observation	Inference
1	Ninhydrin reaction	Ninhydrin reagent	Purple colour was formed.	presence of all amino acids
2	Xanthoproteic reaction	Conc. Nitric acid	Yellow colour developed.	presence of threonine, methionine, tryptophan.
3	Glyoxylic reaction	Glacial acetic acid & Conc. sulphuric acid	A violet ring appeared at the junction of the two layers.	presence of the amino acid tryptophan (This is a specific test for tryptophan.)
4	Sakaguchi reaction	40 % NaOH, α -naphthol & bromine water	Red colour developed.	presence of arginine



Before spraying ninhydrin reagent



After spraying ninhydrin reagent

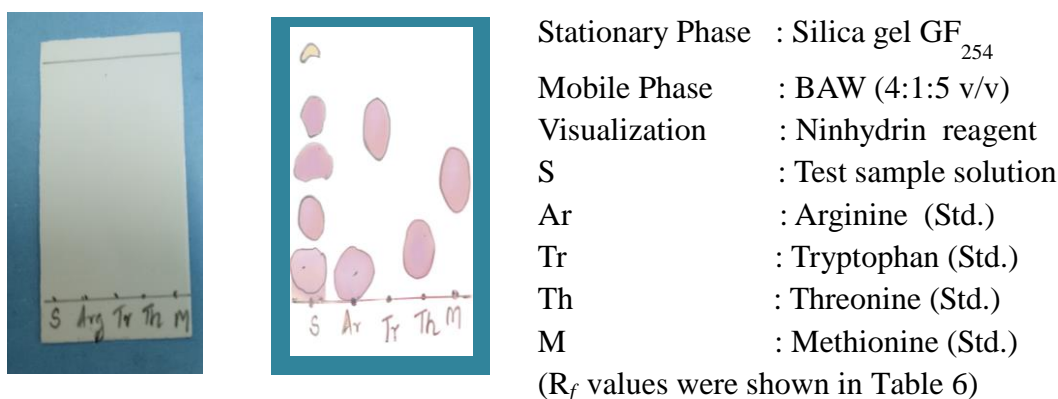
Stationary Phase : Silica gel GF₂₅₄
 Mobile Phase : BAW (4:1:5 v/v)
 Visualization : Ninhydrin reagent
 S : Test sample solution
 (R_f values were shown in Table 6)

Figure (5) Separation of amino acids in test sample solution (96 % ethanol extract) of *M. sapientum* (Yay-thi Banana) by thin layer chromatography

Table (6) R_f Values of Standard Amino Acids and Test Sample Solution (96 % Ethanol Extract) of the Fruit of *M. sapientum* (Yay-thi Banana) by TLC.

No.	Amino acids	R_f values of standard amino acids*	R_f values of amino acids in test sample solution
1	Arginine	0.11	0.11
2	Tryptophan	0.60	0.58
3	Threonine	0.28	0.21
4	Methionine	0.47	0.43

*(Marmor, 1987)



Before spraying ninhydrin reagent After spraying ninhydrin reagent

Figure (6) Separation and identification of amino acids in test sample solution (96 % ethanol extract) of *M. sapientum* (Yay-thi Banana) with the comparison of standard amino acids by thin layer chromatography

Extraction of the Fruit of *Musa sapientum* by Various Solvents

Extraction of the fruit of *M. sapientum* (Banana) was carried out by various solvents such as petroleum ether, ethyl acetate, 96% ethanol and water and also applied for antimicrobial activity. For the fruit of *M. sapientum*, petroleum ether extract (4.2%), ethyl acetate extract (8.6%), 96% ethanol extract (16.4%) and water extract (13.4%) were obtained. It was assumed that relatively non-polar constituents might contain in petroleum ether extract and in ethyl acetate extract, moderately polar compounds whereas in 96% ethanol extract, polar compounds and in water extract more polar components may involve.

Investigation of Antimicrobial Activity of Four Crude Extracts from *Musa sapientum* by Using Paper Disc Diffusion Method

In traditional medicine, many plants or herbs are claimed to have therapeutic efficacy without any scientific basis. The aim of the present study is to evaluate bioactive composition, performance by antimicrobial activity of selected fruit sample with particular reference to pathogenic microorganisms potential to cause plant diseases, diarrhea, typhoid, food poisoning, gastrointestinal (GI) tract infection and abscess in skin, nose.

In this present work, antimicrobial activity of four crude extracts from the fruit of *M. sapientum* was investigated on ten species of microorganisms, shown in Table 7 by paper disc diffusion method at Department of Chemistry, Hinthada University. Paper disc diffusion method is based on the inhibition zone diameter in millimeter (mm) of paper disc and larger the zone diameter is the more activity on the tested microorganisms. Thus, it was noted that the sensitivity varies within the strains judging the size of zones of inhibition. The tested organisms comprised of the Gram-positive bacteria: *Bacillus subtilis* IFO90571, *Micrococcus luteus* NITE83297, *Staphylococcus aureus* AHU8465 and Gram-negative bacteria: *Agrobacterium tumefaciens* NITE09678, *Salmonella typhi* AHU9743, *Escherichia coli* AHU5436, *Pseudomonas fluorescens* IFO94307 besides *Aspergillus parasciticus* IFO5123, *Candida albicans* NITE09542, *Saccharomyces cerevisiae* NITE52847 as fungus. The results of antimicrobial activity of the four crude extracts from the fruit of *M. sapientum* and related Figures were shown in Table 7, Figure 7 and Figure 8. The measurable zone diameter in (mm) is a measure of the degree of antimicrobial activity. In Table 7, the mean zone

diameters of the fruit of *M. sapientum* were generally found to range from 9 to 22 mm whereas PE, EtOAc and 96 % EtOH extracts didn't show activity on *Saccharomyces cerevisiae* NITE52847. Out of the four crude extracts, water extract showed against all tested microorganisms with the inhibition range 9 mm to 18 mm. Based on the finding data, four crude extracts showed the most potent inhibition zone diameters (18-22) mm on *Candida albicans* NITE09542 and it could be nearly comparable with inhibition zone diameter (14-37) mm of Chloramphenicol (Std.). Therefore, it has more pronounced antifungal action than that of antibacterial action. From the antimicrobial screening, four crude extracts from the fruit of *M. sapientum* would be more effective for the treatment in candidiasis of vagina, intestinal tract and mouth caused by fungal infection.

Table (7) Antimicrobial Activity of Four Crude Extracts from Fruit of *M. sapientum*.

Sample	Inhibition zone diameter (mm)									
	A	B	C	D	E	F	G	H	I	J
PE Crude Extract	10	12	10	21	15	10	9	-	13	9
EtOAc Crude Extract	10	10	10	22	9	11	9	-	10	15
96 % EtOH Crude Extract	10	9	9	18	9	16	9	-	13	9
Water Crude Extract	10	13	10	18	9	13	9	10	10	10
Chloramphenicol (Std.)	26	27	24	37	31	29	14	22	30	35

Inhibition zone diameter – 9 mm ~ 14 mm (+), 15mm ~ 19mm (++) Disc diameter = 8 mm

20 mm ~ above (+++)

- = no activity

Tested microorganisms (From the source of NITE & Kyowa Hakko Co. Ltd., *)

A = *Agrobacterium tumefaciens* NITE09678

F = *Salmonella typhi* AHU9743

B = *Aspergillus parasiticus* IFO5123

G = *Escherichia coli* AHU5436

C = *Bacillus subtilis* IFO90571

H = *Saccharomyces cerevisiae* NITE52847

D = *Candida albicans* NITE09542

I = *Pseudomonas fluorescens* IFO94307

E = *Micrococcus luteus* NITE83297

J = *Staphylococcus aureus* AHU8465

* Biotechnology and Development Center of Pathein University

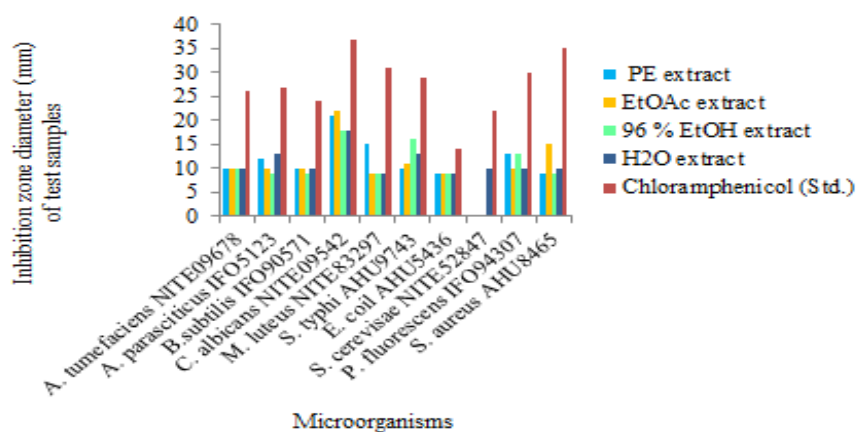
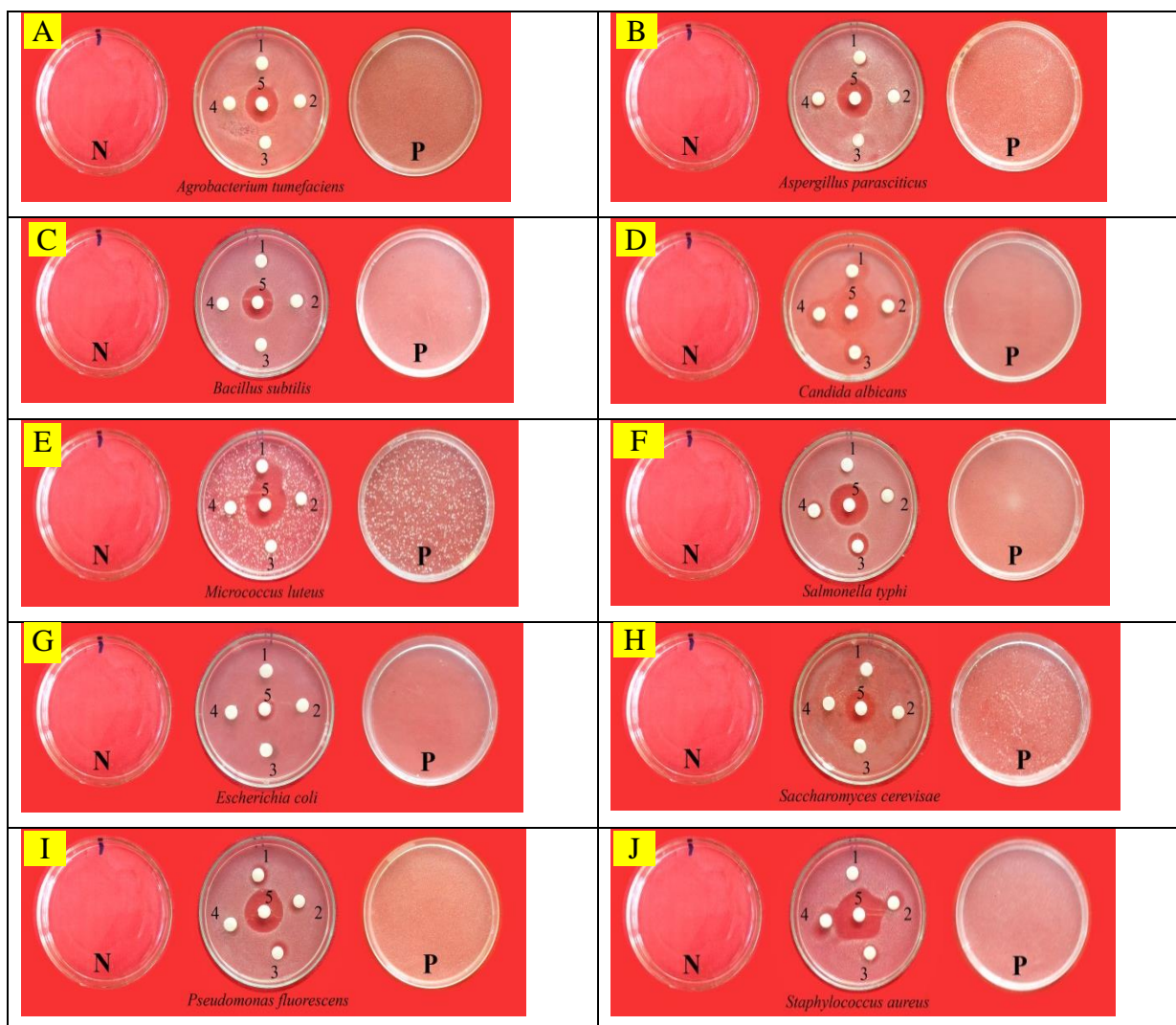


Figure (7) Antimicrobial activity of four crude extracts from the fruit of *M. sapientum* on ten microorganisms by using paper disc diffusion method.



Tested microorganisms

- A = *Agrobacterium tumefaciens* NITE09678
- B = *Aspergillus parasciticus* IFO5123
- C = *Bacillus subtilis* IFO90571
- D = *Candida albicans* NITE09542
- E = *Micrococcus luteus* NITE83297

- F = *Salmonella typhi* AHU9743
- G = *Escherichia coli* AHU5436
- H = *Saccharomyces cerevisiae* NITE52847
- I = *Pseudomonas fluorescens* IFO94307
- J = *Staphylococcus aureus* AHU8465

Counterclockwise position

- 1. PE extract
- 2. EtOAc extract
- 3. 96 % EtOH extract
- 4. Water extract
- 5. Chloramphenicol (Std.)
- N. (-) ve control
- P. (+) ve control

Figure (8) Antimicrobial activity of four crude extracts from *M. sapientum* (Banana)

Conclusion

From the overall assessment of the present work concerning some phytochemical constituents, some chemical analyses and antimicrobial activity from the fruit of *M. sapientum* (Banana), the following inferences could be deduced. The preliminary phytochemical tests on fruit of *M. sapientum* (Banana) revealed the presence of alkaloids, α -amino acids, carbohydrates, flavonoids, glycosides, organic acids, phenolic compounds, reducing sugars, saponins, starch, steroids, tannins and terpenoids but the absence of cyanogenic glycosides in the fruit of *M. sapientum* (Banana) sample. EDXRF spectrum showed that potassium (K) content is distinctly higher than that of the other included elements: S, Fe and Cu. So, *M. sapientum* (Banana) may be suitable for hypertension as the high contents of potassium can control the high blood pressure. The nutritional values for the fruit of *M. sapientum* (Banana) were found to be good source of carbohydrate and energy value whereas fat and protein contents were very low. Thus it was denoted that fruit of *M. sapientum* has a great nutritional significance. In addition, vitamin C (Ascorbic acid) content in the fruit sample was found to be 18.2 mg per 100 g fresh weight sample. In this research work, the amino acid contents from the fruit of *M. sapientum*, local name Yay-thi Banana were qualitatively investigated. According to the qualitative tests, Yay-thi banana consists of four essential amino acids such as arginine, tryptophan, threonine and methionine which cannot produce in human body. Eating banana helps to alleviate the depressed mood because tryptophan in banana is converted into serotonin helping to improve the mood of the depressed persons. Therefore, the fruit of Yay-thi banana is suitable to eat for good health. Next, four crude extracts were prepared from fruit of *M. sapientum* (Banana) using petroleum ether, ethyl acetate, 96% ethanol and water as their solvent polarity. Out of these extracts, 96% ethanol extract was obtained with the highest yield percent and it may contain bioactive polar compounds. Then, these four crude extracts were screened the antimicrobial activity against ten tested microorganisms by paper disc diffusion method. Out of the four crude extracts, water extract showed antimicrobial activity with the related zone diameter (9-18) mm on ten tested microorganisms: *Agrobacterium tumefaciens* NITE09678, *Aspergillus parasciticus* IFO5123, *Bacillus subtilis* IFO90571, *Candida albicans* NITE09542, *Micrococcus luteus* NITE83297, *Salmonella typhi* AHU9743, *Escherichia coli* AHU5436, *Saccharomyces cerevisiae* NITE52847, *Pseudomonas fluorescens* IFO94307 and *Staphylococcus aureus* AHU8465 responsible for plant diseases, diarrhea, typhoid, food poisoning, GI tract infection and abscess in skin and nose. Based on the finding of the present study, it was concluded that the fruit of *M. sapientum*, local name Yay-thi Banana possess many nutritional values as well as valuable amino acids. In addition, the selected fruit sample possesses not only nutrient elements that show anti-secretory activity in gastrointestinal infections but also antimicrobial activity. Since some nutrient elements found in the fruit of *M. sapientum* benefit to human health, it could be suggested to be safely and widely used in food industry.

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